



# Regionalized Sea Level Change & Extreme Water Level Scenarios



**Online Graphical  
User Interface  
(GUI) User Guide**

**v3.0**

October 2020

Department of Defense (DoD)

## INTRODUCTION

### Purpose

The Department of Defense (DoD), through its Military Services, is assessing its vulnerability and potential impacts from climate change at locations where it has permanent or enduring assets. Initial assessments began with coastal and tidally influenced DoD sites to establish a baseline of current weather and climate vulnerabilities and to look ahead to possible future conditions. This approach was later extended to inland sites.

Concurrent with these efforts, DoD's Climate Change Adaptation Working Group (CCAWG) charged an Office of Secretary of Defense-led inter-agency working group, the Coastal Assessment Regional Scenario Working Group (CARSWG), to develop *site-level* adjustments for projected future *global* sea-level rise (SLR) and extreme water level (EWL) conditions. In other words, the **task was to develop localized adjustments leading to different future SLR and EWL scenarios to support the**

**next phase of vulnerability and impact assessment for DoD coastal and tidally influenced sites worldwide.**

Uncertainties are inherent in projecting future climate. **Scenarios are, therefore, non-probabilistic but plausible depictions of future conditions that enable decision-makers to bound their risk based on the best available science.** The scenarios provided as part of this tool take into account physical processes, local setting, and data availability to provide a basis for the values provided. **The information is provided in terms of several future timeframes—2035, 2065 and 2100—that are relevant to management and planning horizons.**

These scenarios enable a decision-maker to add temporal and physically-based information to assess future vulnerabilities to compare against the baseline assessments. Although these scenarios are intended to be used in a “screening” context and not detailed engineering design, their development collectively represents several advancements in scenario development for coastal locations

that can serve as a starting point for other applications that are concerned with assessing and responding to climate-change related risk in the coastal environment.

### Products

Two products have been developed:

- ☑ **A report** (Hall et al. 2016) that documents the methods used to develop the scenarios, accompanied by case studies and other information that illustrate their application, and
- ☑ **A database** with a Graphical User Interface (GUI) that provides users access to the scenario information for specific military sites.

This User Guide provides basic information on accessing and interpreting information in the database.

### Military Sites Included

Candidate sites (as defined in DoD's real property database) were determined by using geographic information system (GIS)

data to define a 20-kilometer coastal shoreline buffer and then identifying sites within that buffer. Please note that an installation may contain several “sites.” In addition, other sites that occurred outside the buffer but were located at the head of estuaries or along the tidal portion of major rivers (i.e., potentially tidally influenced sites) were identified. Based on these filters, **1,813 sites worldwide were identified for inclusion in the database.** Note that the database contains an additional 39 sites that were added subsequent to the analysis of the original 1,774 sites in Hall et al. (2016). Some sites may be at elevations that may obviate scenario application. For sites whose lowest points could be determined, those sites above a 30-meter threshold were retained in the database but “flagged.” (See Hall et al. 2016 for further details, including the basis for the threshold value.)

### Five Global Sea Level Change Scenarios – Basis and Characteristics

Hall et al. (2016) used the bounding scenarios (i.e., 0.2 m [0.7 ft] and 2.0 m [6.6 ft]) prepared for the Third National

Climate Assessment as their initial set of *global* sea level change scenarios. The authors of that report (Parris et al. 2012) expressed a very high confidence (greater than 9 in 10 chance) that future global mean sea levels would not fall outside that range, but did not assign specific probabilities or likelihoods to any of the individual scenarios addressed in their report. Findings since the publication of those scenarios have supported the use of these bounding conditions for vulnerability assessment and associated risk management.

For purposes of this database, Hall et al. (2016) also developed three intermediate scenarios (0.5 m, 1.0 m, and 1.5 m). In addition, they included bases and storylines for each of the scenarios.

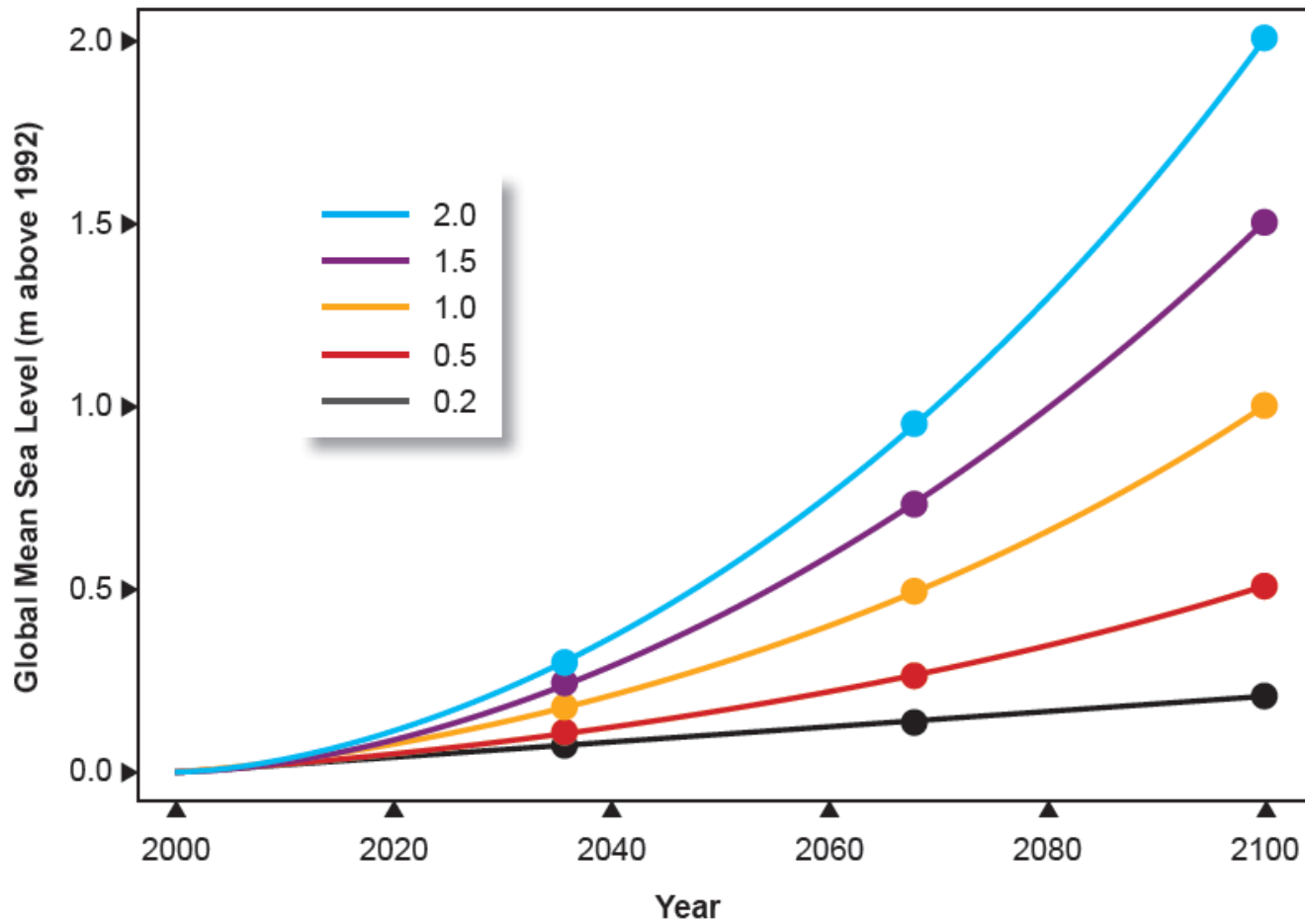
The five global scenarios have a baseline of 1992 (the last tidal epoch for which mean sea level data are available from the National Oceanic and Atmospheric Administration) and end in 2100. The figure on the following page depicts the five scenarios, as well as approximate values for each scenario at the time periods of 2035, 2065, and 2100. The 0.2-

m scenario extends linearly from 1992 to 2100, whereas the other four scenarios are assumed to have a quadratic form, based on differing assumptions of sea-level rise acceleration in the future. Note: sea levels will exhibit natural variability at any point in time, so the specific scenario value at a particular point in time will have additional uncertainty associated with it due to this natural variability.

Hall, J.A., S. Gill, J. Obeysekera, W. Sweet, K. Knuuti, and J. Marburger. 2016. *Regional Sea Level Scenarios for Coastal Risk Management: Managing the Uncertainty of Future Sea Level Change and Extreme Water Levels for Department of Defense Coastal Sites Worldwide*. U.S. Department of Defense, Strategic Environmental Research and Development Program. 228 pp.

Parris, A.P., P. Bromirski, V. Burkett, D. Canyon, M. Culvert, J. Hall, R. Horton, K. Knuuti, R. Moss, J. Obeysekera, A. Sallenger, and J. Weiss. 2012. *Global Sea Level Rise Scenarios for the US National Climate Assessment*. NOAA Technical Memorandum OAR CPO-1. 37 pp.

## DoD GLOBAL SEA LEVEL RISE SCENARIOS



Five Global Sea-Level Rise Scenarios Advanced in Support of this Database

## ACCESSING THE SITE

### Getting Started

- Visit the web application homepage via an internet browser @ <https://sealevelscenarios.serdp-estcp.org>
- Select **Get Started** to begin

The screenshot shows the homepage of the "DoD Regionalized Sea Level Change & Extreme Water Level Scenarios" web application. The background is a deep blue with a subtle, wavy pattern. At the top center, the title "DoD Regionalized Sea Level Change & Extreme Water Level Scenarios" is displayed in white, with a subtitle below it: "Scenarios for screening-level vulnerability assessments for Department of Defense coastal & tidally influenced sites". A prominent green button with the text "Get Started" is centered below the title. Below the button, a horizontal line separates the header from three columns of information. Each column has a heading in white: "WHAT ?" (with a question mark icon), "WHY ?" (with a question mark icon), and "HOW ?" (with a question mark icon). Each heading is followed by a short paragraph of text in white.

**DoD Regionalized Sea Level Change & Extreme Water Level Scenarios**  
Scenarios for screening-level vulnerability assessments for Department of Defense coastal & tidally influenced sites

**Get Started**

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**WHAT ?**  
The tool provides a range of site-specific scenarios of future sea level change for three time horizons in the 21st century.

**WHY ?**  
Department of Defense (DoD) sites worldwide are potentially exposed to impacts from sea level change and extreme water levels. Given the uncertainties in future sea level change magnitude and timing, scenarios can assist in bounding and managing risks.

**HOW ?**  
Global scenarios adjusted for local conditions enable planners and managers to understand and assess future sea level change and storm surge at a location.

## Homepage

- Select **View Report** to view the full report
- Select **Site Lookup** to search sites listed in a text-based format with filters
- Select **Map View** to view a world map of sites (enables various levels of zoom and direct selection of sites)
- Select **Services Dashboard** to view highest scenarios by military service

The screenshot shows the DRSL homepage with a dark header containing navigation links: DRSL, SITE LOOKUP, MAP VIEW, SERVICES, CONTACT US, and USER GUIDE. The main content area features the title "Regional Sea Level Scenarios for Coastal Risk Management" and a sub-header "Managing the uncertainty of future sea level change and extreme water levels for Department of Defense coastal sites worldwide". A prominent blue button labeled "VIEW REPORT" with a PDF icon is highlighted by a red arrow. A callout box points to this button, containing the following text:

**Downloading the Hall et al. (2016) report:**  
Clicking here will allow you to directly download the entire report in PDF format.

Hall, J.A., S. Gill, J. Obeysekera, W. Sweet, K. Knutti, and J. Marburger. 2016. Regional Sea Level Scenarios for Coastal Risk Management: Managing the Uncertainty of Future Sea Level Change and Extreme Water Levels for Department of Defense Coastal Sites Worldwide. U.S. Department of Defense, Strategic Environmental Research and Development Program. 224 pp.

Below the main content, there are three circular icons representing different features: "Site Lookup" (green icon, "Search for specific sites"), "Map View" (blue icon, "View all sites via world map"), and "Service Dashboard" (yellow icon, "View highest scenarios by military service").

## Site Lookup

- Lookup sites by Site Name, Primary Installation, City, State, and Country
- Select column names to **sort** sites and render up to 60 sites at a time (e.g., showing 10 entries per page, as seen below)
- *Note: remaining screenshots come from multiple sites*

DRSL | SITE LOOKUP | MAP VIEW | SERVICES | CONTACT US | USER GUIDE

### Regionalized Sea Level Change & Extreme Water Level Scenarios

SEARCH RESULTS Results are limited to 60 sites

Type here to filter by keyword

Show 10 entries

SITE	PRIMARY INSTALLATION	CITY	STATE	COUNTRY
<a href="#">4th MARDIV Brooklyn NY</a>	HDQTRS 4TH MARDIV NEW ORLEANS	New York City	New York	United States
<a href="#">4th MARDIV Jacksonville Maint</a>	HDQTRS 4TH MARDIV NEW ORLEANS	Jacksonville	Florida	United States
<a href="#">Aberdeen Proving Ground</a>	Aberdeen Proving Ground	Aberdeen	Maryland	United States
<a href="#">ALF Bogue</a>	MCAS CHERRY POINT NC	Bogue	North Carolina	United States
<a href="#">ALF Cabaniss</a>	NAS CORPUS CHRISTI TX	Corpus Christi	Texas	United States
<a href="#">ALF Fentress Chesapeake</a>	NAS OCEANA VA	Virginia Beach	Virginia	United States
<a href="#">ALF Waldron</a>	NAS CORPUS CHRISTI TX	Corpus Christi	Texas	United States
<a href="#">Alamamu Military Reservation</a>	Fort Shafter	Honolulu	Hawaii	United States
<a href="#">Andersen AFB</a>	NSA ANDERSON	Andersen Ab	Guam	Guam
<a href="#">Arlington National Cemetery</a>	Arlington National Cemetery	Arlington	Virginia	United States

Showing 1 to 10 of 301 entries

Previous 1 2 3 4 5 ... 31 Next

## Site Lookup – Search Results

- Type keywords into the search field to **filter** search results (field begins displaying results as partial matches made)
- Select a Site name to view **site-specific data**

The screenshot shows the DRSL website interface. The top navigation bar includes links for SITE LOOKUP, MAP VIEW, SERVICES, CONTACT US, and USER GUIDE. The main heading is "Regionalized Sea Level Change & Extreme Water Level Scenarios". Below this is a search results box with the following elements:

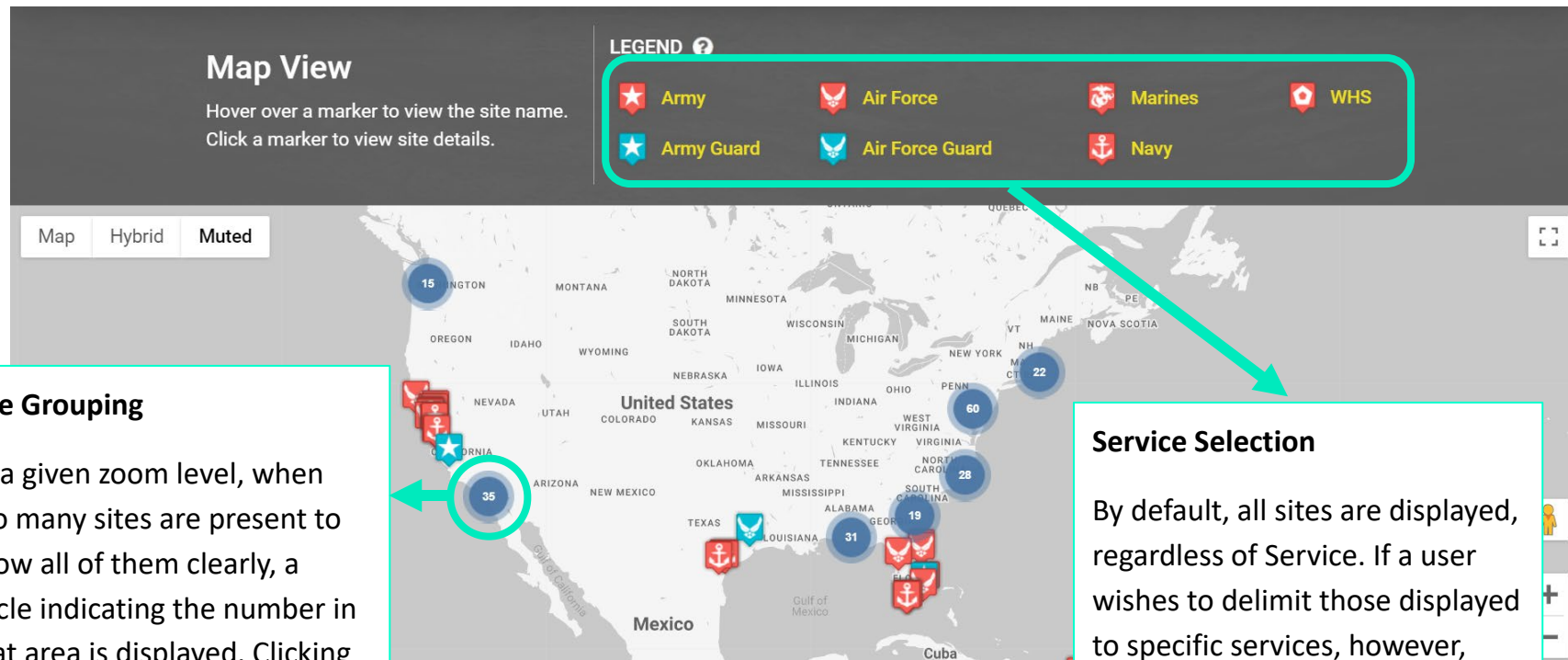
- Search icon and "SEARCH RESULTS" label with a note: "Results are limited to 60 sites".
- Search input field containing "naval hospital".
- Dropdown menu for "Show 10 entries".
- Table with columns: SITE, PRIMARY INSTALLATION, CITY, STATE, COUNTRY.
- Table row: Naval Hospital, NAVBASE GUAM, Agana, Guam, Guam.
- Footer text: "Showing 1 to 1 of 1 entries (filtered from 301 total entries)".
- Navigation buttons: Previous, 1, Next.

SITE	PRIMARY INSTALLATION	CITY	STATE	COUNTRY
Naval Hospital	NAVBASE GUAM	Agana	Guam	Guam



## Map View

- Use the +/- buttons at the bottom right-hand corner of the screen to **zoom in (+)** and **zoom out (-)** on the map
- To **drag** the screen, first click anywhere on the map and hold down the mouse button, then move the mouse as desired



### Site Grouping

At a given zoom level, when too many sites are present to show all of them clearly, a circle indicating the number in that area is displayed. Clicking on these circles will zoom in to that area to see individual sites. Orange circles indicate over 100 sites in the area, whereas blue circles have less than 100.

### Service Selection

By default, all sites are displayed, regardless of Service. If a user wishes to delimit those displayed to specific services, however, clicking on these Service buttons will remove them from the display. This action is confirmed by the respective Service button lettering changing from yellow to gray.

## Map View – Accessing Site Data

- When hovering the mouse over a site the site name will display, and clicking on a site will open a **Detail** popup
- *Note: this page can also be viewed in “Map” or “Hybrid” formats, and that terrain and labels can be added or removed*

**Map View**  
Hover over a marker to view the site name.  
Click a marker to view site details.

**LEGEND**

- Army
- Air Force
- Marines
- WHS
- Army Guard
- Air Force Guard
- Navy

Map Hybrid Muted

ITC Camp San Luis Obispo  
Site Code  
06F35  
Installation Name  
Camp San Luis Obispo  
Installation Code  
06F35

[VIEW SITE](#)

**Service Icon**

For each site, a Service icon is shown that corresponds to those in the Legend, above. For example, Air Force.

**Viewing Site Data**

Limited identification information is displayed about a given site in map view mode. To see the associated SLR/EWL database information, click the **VIEW SITE** link. This will bring you to the respective site-specific data page.

# REVIEWING SITE DATA

## Sea Level Change

- A site's **Sea Level Change** Scenarios are displayed on the initial site data page (see example interpretation in the box below)

**Interpreting Site Data**  
For example, applying the **Highest** global SLR scenario (2.0-meter rise by 2100), regional adjustments for this site would result in a total rise of **2.6 meters** by 2100, compared to the 1992 baseline.

**NS Norfolk**  
Installation **NAVSTA NORFOLK VA**  
Latitude **36.943507** Longitude **-76.299056** Lowest Elevation **-2.4 meters**  
Reference Datum **NAVD88** Mean Sea Level is **0.090 meters** below **NAVD88** Mean Higher High Water is **0.340 meters** above **NAVD88**

Sea Level Change | Extreme Water Levels | Combined | Outlook | Tide Gauges

Regionalized Sea Level Change Scenarios

Tables and chart below provide site-specific adjustments values whose magnitudes are dependent on the global scenario, time horizon, and site-specific factors. All values are relative to global mean sea level (referenced to 1992, the US 1983-2001 National Tidal Data Epoch [NTDE]).

User choice include selection of the appropriate time horizon, global sea level scenarios, and unit (meters or feet). User can apply the adjustment values to any vertical datum, as long as the units (meters or feet) are the same.

Global Scenario	2035	2065	2100
Lowest	0.2	0.3	0.5
Highest	0.5	1.1	2.6

Base Unit → Meters

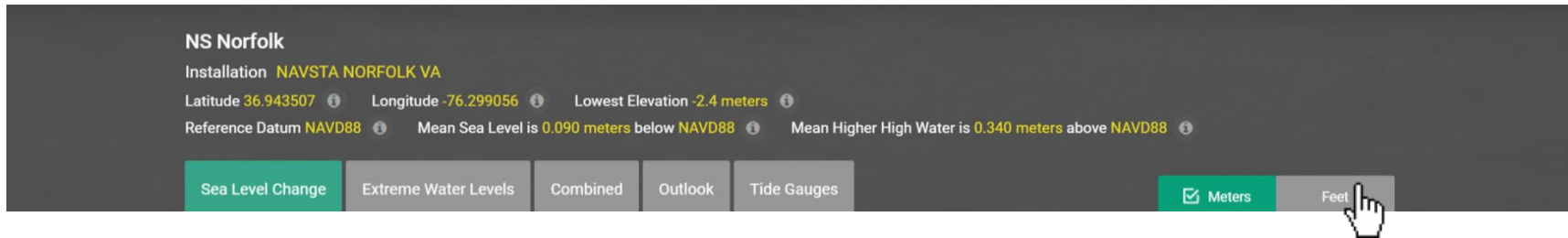
Scenario	2035	2065	2100
Lowest	0.2	0.3	0.5
Highest	0.5	1.1	2.6

2035 Scenarios | 2065 Scenarios | 2100 Scenarios

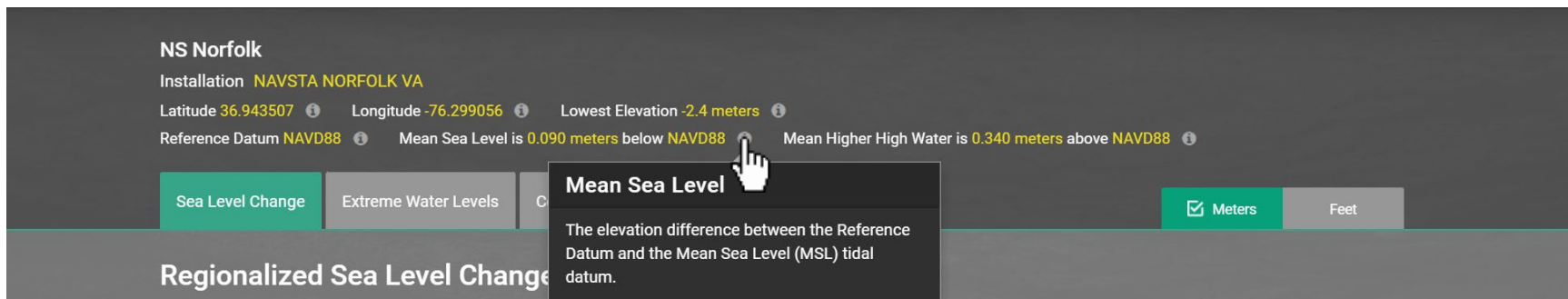
Global Scenario	Global SLR	Site-Specific Adjustments			Total Site-Specific Adjustments	Site-Specific Sea Level Change Projections
		Vertical Land Movement	Ocean Circulation	Ice Melt Effects		
Lowest (0.2)	0.1	0.1	0.0	0.0	0.1	0.2
Low (0.5)	0.1	0.1	0.0	0.0	0.1	0.2

## Sea Level Change – Site Header

- In the Site header, site specific information is displayed
- This header remains the same across the application
- Below the site-specific information, there are Tabs with the Sea Level Change (highlighted in green)
  - Some sites do NOT have Extreme Water Level data and in those cases, the Extreme Water Levels and Combined tabs will NOT be displayed
  - On the far-right side, you can change units from meters (default) to feet and ALL the data in the application will convert including site header data

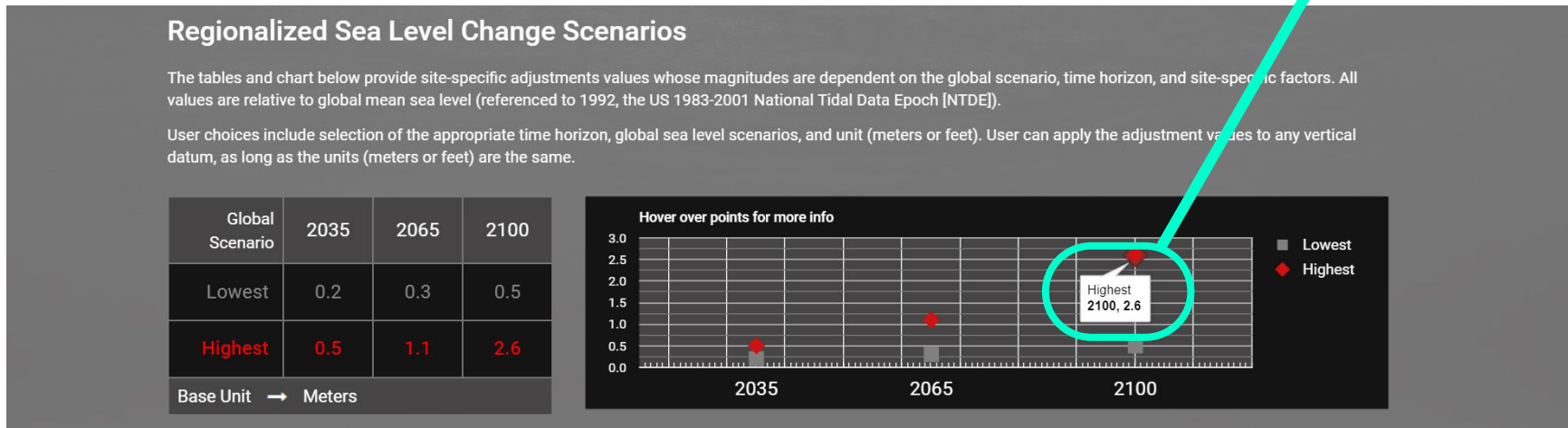


- Throughout the application, you can move your mouse cursor over information icons to learn more about data fields



## Sea Level Change – Data Summary

- Below the Site header, a data summary is displayed including a table and corresponding graph
- The table includes three time horizons and the lowest and highest scenarios
- The graph reflects the table data
  - You can also move your mouse cursor over each data point to display the scenario, time horizon, and corresponding value



## Sea Level Change – Data breakdown

- Click on any of the time horizons (blue boxes) to view detailed data
- Under each time horizon, data are broken down into multiple scenarios (one on each row)
- For more information about each column, move your mouse cursor to the info icons in the column headers

Global Scenario	Global SLR	Site-Specific Adjustments			Total Site-Specific Adjustments	Site-Specific Sea Level Change Projections
		Vertical Land Movement	Ocean Circulation	Ice Melt Effects		
Lowest (0.2)	0.1	0.1	0.0	0.0	0.1	0.2
Low (0.5)	0.1	0.1	0.0	0.0	0.1	0.2
Medium (1.0)	0.2	0.1	0.0	0.0	0.1	0.3
High (1.5)	0.2	0.1	0.1	0.0	0.2	0.4
Highest (2.0)	0.3	0.1	0.1	0.0	0.2	0.5

Base Unit → Meters

Regionalized Sea Level Change Scenario Formula:  
Site-Specific Sea Level Change Scenario = Global SLR (t) + Total Site-Specific Adjustments (t)

For example, for the **0.5-meter (Low)** Global SLR scenario: Vertical Land Movement adds an additional 0.1 m, Ocean Circulation adds 0.0 m, and Ice Melt Effects adds 0.0 m to the 0.5-meter Global SLR scenario, for a total of **0.2 m** SLR at this site in 2035, compared to the 1992 baseline.

## Sea Level Change – Ice Melt Effects Breakdown I

- View the component-level **breakdown** of Ice Melt Effects by hovering over an ice cube icon (if available)
- This breakdown is **always presented in meters** (whereas all other GUI values can be displayed in Meters or Feet – this limitation for ice melt components prevents rounding errors associated with unit conversions at the component level)
- three individual component values are first added, for a total of 0.010 m, which is then rounded to 0.0 m total for the Ice Melt Effects contribution [2.0-meter (Highest) scenario, 2065; in this case, contribution magnitudes are fairly similar for all three components]

2035 Scenarios		2065 Scenarios			2100 Scenarios	
Global Scenario	Global SLR	Site-Specific Adjustments			Total Site-Specific Adjustments	Site-Specific Sea Level Change Projections
		Vertical Land Movement	Ocean Circulation	Ice Melt Effects		
Lowest (0.2)	0.1	0.1	0.0	0.0	.1	0.2
Low (0.5)	0.2	0.1	0.1	0.0	.2	0.4
Medium (1.0)	0.4	0.1	0.1	0.0	.2	0.6
High (1.5)	0.6	0.1	0.1	0.0	.2	0.8
Highest (2.0)	0.8	0.1	0.1	0.0	.2	1.0

Ice Melt Effects Breakdown (2065)	
Antarctica	0.08
Glacier	-0.02
Greenland	-0.05
<b>Total</b>	<b>0.010</b>

Base Unit → Meters

## Sea Level Change – Ice Melt Effects Breakdown II

2035 Scenarios		2065 Scenarios		2100 Scenarios		
Global Scenario	Global SLR	Site-Specific Adjustments			Total Site-Specific Adjustments	Site-Specific Sea Level Change Projections
		Vertical Land Movement	Ocean Circulation	Ice Melt Effects		
Lowest (0.2)	0.2	0.1	0.0	0.0	.1	0.3
Low (0.5)	0.5	0.1	0.1	0.0	.1	0.6
Medium (1.0)	1.0	0.1	0.2	0.0	.2	1.2
High (1.5)	1.5	0.1	0.2	0.0	.2	1.7
Highest (2.0)	2.0	0.1	0.3	0.0	.4	2.4

Ice Melt Effects Breakdown (2100)	
Antarctica	0.20
Glacier	-0.03
Greenland	-0.19
Base Unit	Meters

In contrast, for the same **2.0-meter (Highest)** scenario but in the later 2100 timeframe, the magnitude of the component adjustment for Antarctica is significantly greater than for Glaciers and Greenland.



## Sea Level Change – Vertical Land Movement Editing

- Users who have *more site-specific information* about Vertical Land Movement (VLM) may wish to substitute that data. Please note that edits made to VLM data will be reset after exiting the GUI. **Edit** VLM values by first **clicking any cell in the VLM adjustment data column**.
- Adjust the values up or down using the mouse, keyboard, or manually typing in a value
- Results of editing the value are then reflected throughout the page

2035 Scenarios		2065 Scenarios			2100 Scenarios	
Global Scenario	Global SLR	Site-Specific Adjustments			Total Site-Specific Adjustments	Site-Specific Sea Level Change Projections
		Vertical Land Movement	Ocean Circulation	Ice Melt Effects		
Lowest (0.2)	0.2	0.3	0.0	0.0	0.3	0.5
Low (0.5)	0.5	0.3	0.1	-0.1	0.3	0.8
Medium (1.0)	1.0	0.3	0.2	-0.1	0.4	1.4
High (1.5)	1.5	0.3	0.2	-0.1	0.4	1.9
Highest (2.0)	2.0	0.3	0.3	0.0	0.6	2.6

Base Unit → Meters

## Extreme Water Levels

- Clicking on the green Extreme Water Levels tab will display a site's Extreme Water Level Statistics reported as heights above mean higher high water (the higher of two high tides experienced per tidal day)

Sea Level Change

Extreme Water Levels

Combined

Outlook

Tide Gauges

Meters

Feet

## Regionalized Extreme Water Level Statistics

Values in the table(s) below are heights above mean higher high water

Note: these water levels do not include the effects of waves. User choices include multiple gauges vs single gauge, % annual chance event, and unit (meters or feet). User must convert value to appropriate reference datum as these values are relative to mean higher high water.

Extreme Water Levels include the effects of the astronomical tide and storm surge. Given that both of these are terms of annual exceedance probability. The probabilities chosen here reflect different return periods for combined interest to planners and managers. Tide gauge information is a common method to estimate extreme water level length of records, dictate the category to which a site belongs and the type of analyses that may be conducted are heights above mean higher high water.

This site belongs to **Category 1** - Site has a local tide gauge within 50 km and with at least 30 years of record.

For example, this means that the EWL associated with the "5% Annual Chance Event" (or "20 Year Event") will reach an elevation of 1.4 meters above mean higher high water (MHHW) for this site.

### Multiple Gauges - Regional Frequency Analysis

A Regional Frequency Analysis (RFA) is a statistical method that provides estimates for extreme event probabilities with the assumption that coastal environments with similar attributes will experience a similar flood frequency. To conduct an RFA, three to five tide gauges of sufficient length of record and proximity to the site of interest are needed. An RFA assists in placing tide gauges with short records into a regional context, enlarging the sampling for rare events both in space and time, and transferring Extreme Water Level information to un-gauged sites. Note: the RFA analysis includes data from the single gauge below.

20% Annual Chance Event [ "5 Year Event" ]	5% Annual Chance Event [ "20 Year Event" ]	2% Annual Chance Event [ "50 Year Event" ]	1% Annual Chance Event [ "100 Year Event" ]
1.1	1.4	1.6	1.7

Base Unit → Meters

## Extreme Water Levels – Category and Data


- Every site belongs to a certain Category based on available Tide Gauge information – **for more details, see text below**
- The **info button** next to the site Category definition provides similar information for all Categories

### Regionalized Extreme Water Level Statistics

Values in the table(s) below are heights above mean higher high water

Note: these water levels do not include the effects of waves. User choices include multiple gauges vs single gauge, % annual chance event, and unit (meters or feet). User must convert value to appropriate reference datum as these values are relative to mean higher high water.

Extreme Water Levels include the effects of the astronomical tide and storm surge. Given that both of these are time varying, their combined effect can be expressed in terms of annual exceedance probability. The probabilities chosen here reflect different return periods for combined storm and tide elevations of different magnitudes of interest to planners and managers. Tide gauge information is a common method to estimate extreme water level statistics. The proximity of gauges to a site, and their length of records, dictate the category to which a site belongs and the type of analyses that may be conducted - single gauge or multiple gauge. Values in the table(s) below are heights above mean higher high water.

This site belongs to **Category 1** - Site has a local tide gauge within 50 km and with at least 30 years of record 

- A site can have either one or both sources of data: Single Gauge Analysis and Regional Frequency Analysis (RFA). RFA is defined below.
- When relevant for the site, “Multiple Gauges – RFA” and/or “Single Gauge” boxes will each display unique values for the four return periods (e.g., “20 Year Event”)
- Section 4.4.4 of Hall et al. (2016) provides a comparative discussion on application of single gauge or RFA results when both are available

#### Multiple Gauges - Regional Frequency Analysis

A Regional Frequency Analysis (RFA) is a statistical method that provides estimates for extreme event probabilities with the assumption that coastal environments with similar attributes will experience a similar flood frequency. To conduct an RFA, three to five tide gauges of sufficient length of record and proximity to the site of interest are needed. An RFA assists in placing tide gauges with short records into a regional context, enlarging the sampling for rare events both in space and time, and transferring Extreme Water Level information to un-gauged sites. Note: the RFA analysis includes data from the single gauge below.

20% Annual Chance Event [ "5 Year Event" ]	5% Annual Chance Event [ "20 Year Event" ]	2% Annual Chance Event [ "50 Year Event" ]	1% Annual Chance Event [ "100 Year Event" ]
1.1	1.4	1.6	1.7
Base Unit → Meters			

## Combined

- Clicking the green Combined tab displays the corresponding Combined Scenario Values

**NS Norfolk**  
Installation **NAVSTA NORFOLK VA**  
Latitude **36.943507** ⓘ Longitude **-76.299056** ⓘ Lowest Elevation **-2.4 meters** ⓘ  
Reference Datum **NAVD88** ⓘ Mean Sea Level is **0.090 meters** below **NAVD88** ⓘ Mean Higher High Water is **0.340 meters** above **NAVD88** ⓘ

Sea Level Change Extreme Water Levels **Combined** Outlook Tide Gauges  Meters Feet

### Combined Scenario Value: Sea Level Change Scenario & Extreme Water Level Statistics

Values in the tables below represent elevations above the reference datum for the combination of sea level change scenario and the selected annual chance event. Note: these water levels do not include the effects of waves. User choices include multiple gauges vs single gauge, annual chance event, and unit (meters or feet).

<b>20% Annual Chance Event</b> [ "5 Year Event" ]	<b>5% Annual Chance Event</b> [ "20 Year Event" ]	<b>2% Annual Chance Event</b> [ "50 Year Event" ]	<b>1% Annual Chance Event</b> [ "100 Year Event" ]
--	--	--	---

% chance in any given year that there will be an extreme water level event of at least this magnitude

## Combined - Formula

- The formula used to calculate the Combined values is displayed at the **bottom** of the page
- Moving your mouse cursor over the **info icon** will display detailed information about each formula component

### Combined Scenario Value: Sea Level Change Scenario & Extreme Water Level Statistics

Values in the tables below represent elevations above the reference datum for the combination of sea level change scenario and the selected annual chance event. Note: these water levels do not include the effects of waves. Other choices include multiple gauges vs single gauge, annual chance event, and unit (meters or feet).

20% Annual Chance Event  
[ "5 Year Event" ]

5% Annual Chance Event  
[ "20 Year Event" ]

2% Annual Chance Event  
[ "50 Year Event" ]

1% Annual Chance Event  
[ "100 Year Event" ]

% chance in any given year that there will be an extreme water level event of at least this magnitude

#### Based on Multiple Gauge Analysis

Global Scenario	2035	2065	2100
Lowest (0.2)	1.6	1.7	1.9
Low (0.5)	1.6	1.9	2.2
Medium (1.0)	1.7	2.1	2.8
High (1.5)	1.8	2.3	3.3
Highest (2.0)	1.9	2.5	4.0

Base Unit → Meters

#### Based on Single Gauge Analysis

Global Scenario	2035	2065	2100
Lowest (0.2)	1.7	1.8	2.0
Low (0.5)	1.7	2.0	2.3
Medium (1.0)	1.8	2.2	2.9
High (1.5)	1.9	2.4	3.4
Highest (2.0)	2.0	2.6	4.1

Base Unit → Meters

Combined Scenario Value Formula:  
**Combined Scenario Value = Global SLR (t) + Total Site-Specific Adjustments (t) + Mean Higher High Water Offset + Extreme Water Levels (ace)** ⓘ  
*where (t) is time and (ace) is % annual chance event*

## Combined - Data

- The page includes four buttons, one for each EWL return period
- Clicking any of these four buttons displays the corresponding table of combined values
- Multiple Gauge (RFA) and/or Single Gauge data will be displayed depending on availability.

**Combined Scenario Value: Sea Level Change Scenario & Extreme Water Level Statistics**

Values in the tables below represent elevations above the reference datum for the combination of sea level change scenario and the selected annual chance event. Note: these water levels do not include the effects of waves. User choices include multiple gauges vs single gauge, annual chance event, and unit (meters or feet).

**20% Annual Chance Event**  
 [ "5 Year Event" ]

**5% Annual Chance Event**  
 [ "20 Year Event" ]

**2% Annual Chance Event**  
 [ "50 Year Event" ]

**1% Annual Chance Event**  
 [ "100 Year Event" ]

% chance in any given year that there will be an extreme water level event of at least this magnitude

**Based on Multiple Gauge Analysis**

Global Scenario	2035	2065	2100
Lowest (0.2)	1.6	1.7	1.9
Low (0.5)	1.6	1.9	2.2
Medium (1.0)	1.7	2.1	2.8
High (1.5)	1.8	2.3	3.3
Highest (2.0)	1.9	2.5	4.0

Base Unit → Meters

**Based on Single Gauge Analysis**

Global Scenario	2035	2065	2100
Lowest (0.2)	1.7	1.8	2.0
Low (0.5)	1.7	2.0	2.3
Medium (1.0)	1.8	2.2	2.9
High (1.5)	1.9	2.4	3.4

Base Unit

This means that for the **1.5-meter (High)** scenario, the combination of regionally adjusted SLR and the EWL associated with the 20% annual chance event (or 5-Year Event) would reach an elevation of 3.3 meters in 2100, compared to the 1992 baseline.

Combined Scenario Value Formula:  
 Combined Scenario Value = Global SLR (t) + Total Site-Specific Adjustments (t) + Mean Higher High V  
 where (t) is time and (ace) is % annual chance event



## Case Studies – Inundation Mapping and Tidal Surface Considerations

- The Hall et al. (2016) report accompanying this database contains guidance on incorporating considerations related to inundation mapping error and tidal surface variation when analyzing the potential impact of SLR and EWL scenarios.
- Section 4.5.3 and Section 5.2.3 contained associated discussion (See slide 7 for where to find the report)

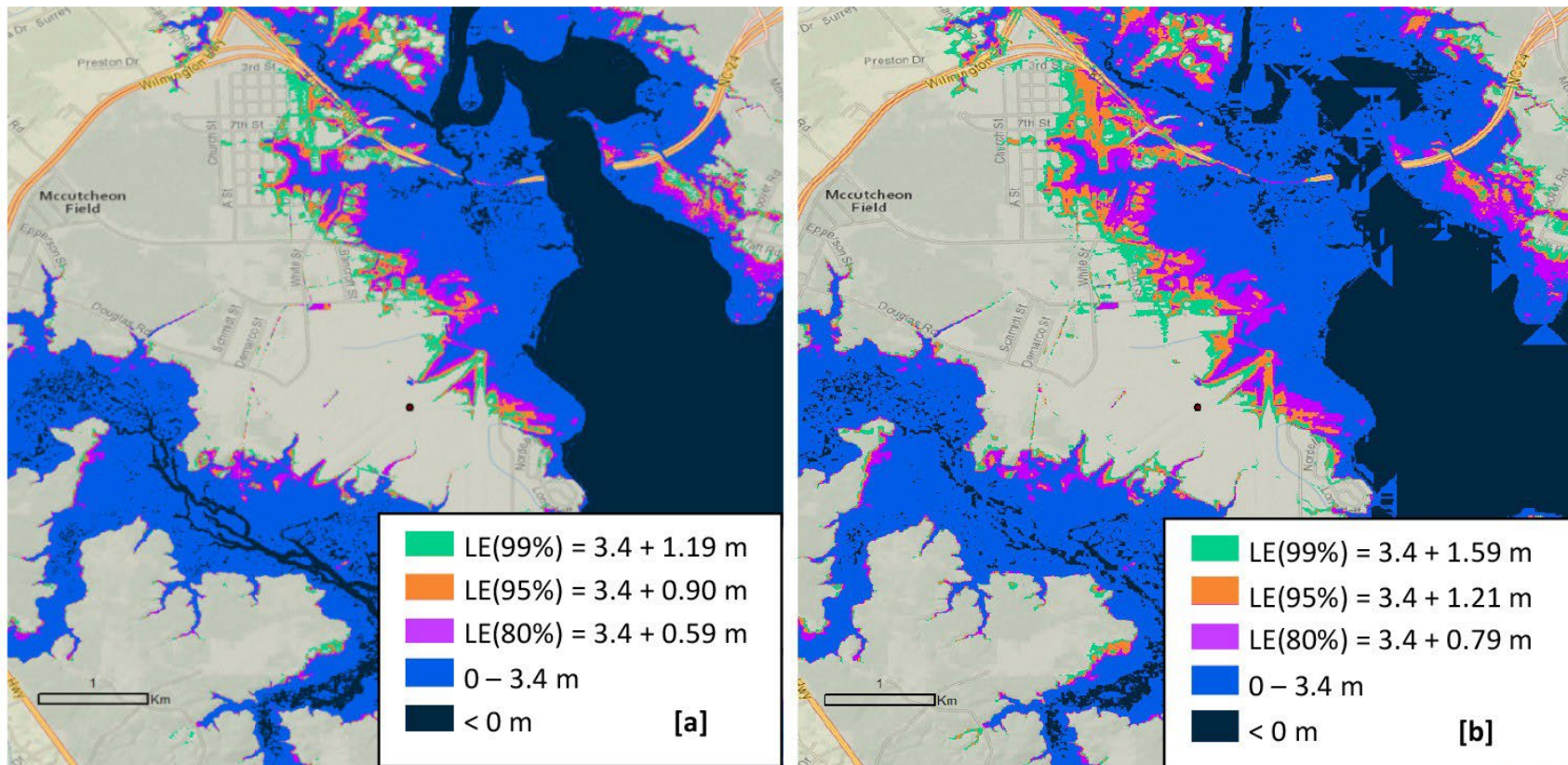
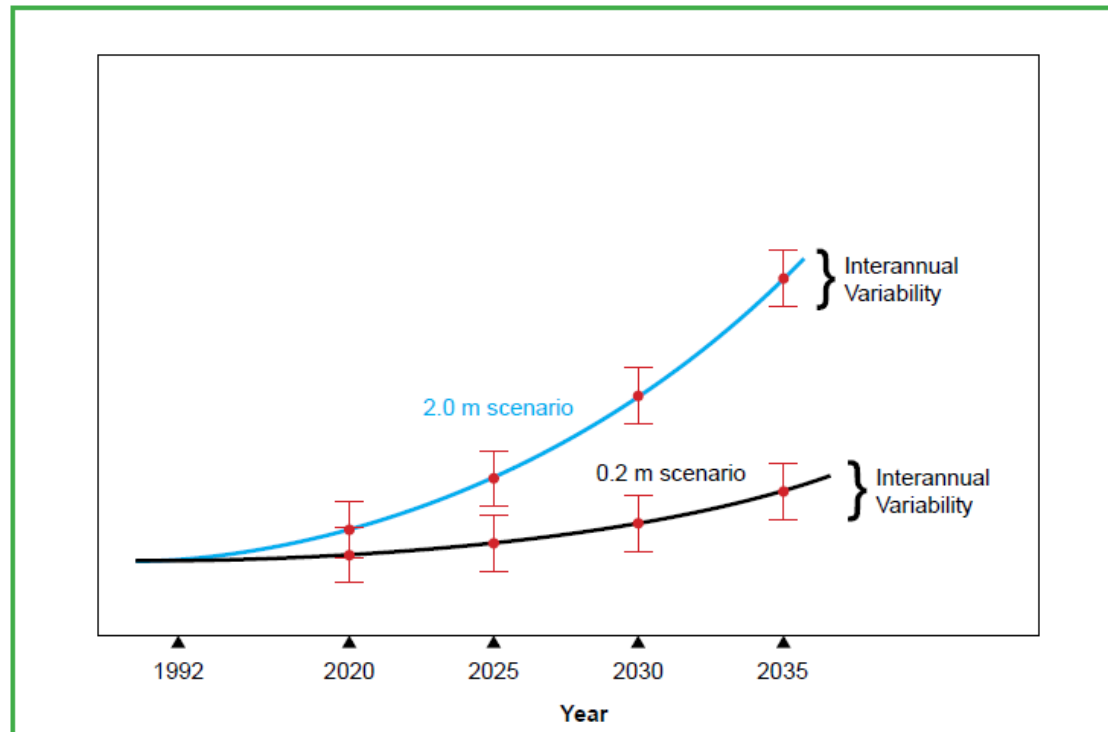


Figure 5.10 MCBCL West Site 3.4-Meter Inundation Map  
([a] NED 1/9 arc-second DEM dataset; [b] NED 1/3 arc-second DEM dataset)

## Case Studies – Making Decisions in the Zero- to 20-Year Timeframe

- Section 5.3.5 of Hall et al. (2016) contains guidance on making decisions with consequences limited to less than 20 years, offering decision-makers interested in more near-term SLR scenarios a simplified set of scenarios and adjustments.
- *(Note that it is incumbent on the decision-maker, however, to decide under what circumstances the consequences of his or her decision do not extend past 20 years and when it is appropriate to apply the simplified approach.)*



### Conceptual Diagram to Illustrate Application of SLR Scenarios in the Zero- to 20-Year Timeframe

The depiction of interannual variability is illustrative and not to scale with the rest of the figure.

**Thank You!**

# **Regionalized Sea Level Change & Extreme Water Level Scenarios**

## **Contact Information**

If you experience difficulty accessing the website or other technical challenges, please send an e-mail to [sealevelscenarios@serdp-estcp.org](mailto:sealevelscenarios@serdp-estcp.org) describing the problem. If you have access and have any other questions, you can use the **CONTACT US** link in the header.

***DoD (Department of Defense)***

***CARSWG (Coastal Assessment Regional Scenario Working Group)***

